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A controlled clinical trial of implant-retained mandibular overdentures: 10 years' results of clinical aspects and aftercare of IMZ implants and Brånemark implants

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Key words: aftercare, clinical aspects, dental implants, overdenture

Abstract: The aim of this prospective randomized controlled clinical trial was to evaluate the clinical outcomes and prosthetic aftercare of edentulous patients with a mandibular overdenture retained by two IMZ implants or two Brånemark implants during a 10-year period. Patients were allocated to the IMZ group ($n = 29$) or the Brånemark group ($n = 32$) by a computerized balancing method. In the IMZ group, four implants were lost during the 10-year follow-up (survival rate: 93%). In the Brånemark group, nine implants were lost (survival rate: 86%). All patients were re-operated successfully. Multiple prosthetic revisions were necessary in both groups; especially the precision attachment system in the overdenture (23% of the total number of revisions) and the denture base and teeth (26% of the total number of revisions) were subject to frequent fracture. From this study, it can be concluded that both the IMZ implant and the Brånemark implant systems supporting an overdenture are functioning well after 10 years of follow-up. There are no indications of a worsening of clinical or radiographical state after 10 years.

Problems involving lack of stability and retention of a lower denture can often be solved using endosseous implants to which an overdenture can be attached. One of the first studies on overdentures retained by endosseous implants was published by Stalblad et al. (1985). Since then, numerous articles have appeared dealing with this subject, concluding that it is a very successful therapy (Chao et al. 1995; Batenburg et al. 1998). However, the literature on prospective studies of overdentures retained by endosseous implants, with a follow-up period of at least 10 years, is limited. Buser et al. (1999) reported an implant 10-year survival rate of 96.2% mainly in the anterior region of the mandible. Mericske-Stern et al. (2001) reported a 91.4% 10-year survival rate, but this group comprised not only mandibular overdentures but also fixed partial dentures and single crowns. Ferrigno et al. (2002) reported a 10-year survival rate of 95.9% of a group treated with overdentures or fixed full-arch bridges. Comparison of implant systems is optimal in a randomized clinical trial (Antczak-Bouckoms & Chalmers 1988; Barmes 1990). Only a few studies have been published with two or more different endosseous implant systems in one prospective study on mandibular overdentures with a follow-up of at least 5 years (Meijer et al. 2000, 2001). A prospective study with at least a 10-year follow-up and with a comparison between two or more implant systems has never been published. The

number of complications and the amount of aftercare related to the superstructure and prosthesis are important with respect to the choice of components. Some studies are known, which address prosthetic aftercare of at least 5 years (Hemmings et al. 1994; Versteegh et al. 1995; Wismeyer et al. 1995; Watson et al. 1997; Visser et al. 2002). The aim of the present randomized clinical trial was to evaluate a set of clinical items and prosthetic aftercare of edentulous patients with a mandibular overdenture retained by two IMZ implants or two Brånemark implants during a 10-year period.

Material and methods

Patient selection

Patients with persistent problems when wearing conventional complete dentures due to reduced stability and insufficient retention of their lower dentures were selected for the study. They were all healthy patients and had been referred to the Department of Oral–Maxillofacial Surgery and Maxillofacial Prosthetics of the University Hospital Groningen by their general practitioner. The patients were informed about the different implant systems, possible risks and the method for assignment to the treatment groups. Informed consent was obtained from all participants. The study was approved by the hospital medical ethical committee. The inclusion criteria for the study were: edentulousness in the upper and lower jaw for at least 1 year, problems with retention and stability of the lower denture, a mandibular bone height between 8 and 25 mm as measured at the symphysis on a lateral cephalometric radiograph, and no medical history of former preprosthetic surgery or contraindications for a surgical procedure.

Two groups of patients were established:

- the IMZ-retained overdenture group (IMZ group): 29 subjects treated with an overdenture retained by two IMZ implants (Friedrichsfeld, Mannheim, Germany) in the lower jaw and a new denture in the upper jaw; and
- the Brånemark-retained overdenture group (Brå group): 32 subjects treated with an overdenture retained by two Brånemark implants (Nobel Biocare, Göteborg, Sweden) in the lower jaw and a new denture in the upper jaw.

Randomized treatment allocation was executed by a computerized balancing method to ensure pretreatment comparability of the groups with respect to age, gender, edentulous period in the lower jaw, number of previously made mandibular dentures, 'age' of the present lower denture and the mandibular bone height (Zielhuis et al. 1990). Characteristics of the two groups are listed in Table 1. There were no relevant differences between the composition of the groups.

Surgical and prosthodontic procedures

All the patients were treated at the University Hospital Groningen by two experienced oral–maxillofacial surgeons and two experienced prosthodontists. The implants were inserted into the interforaminal region of the mandible, and after a 3-month osseointegration period the second-stage surgery was performed (Brånemark et al. 1985; Kirsch & Mentag 1986). Non-osseointegrated implants were removed and, after a healing period, new implants were placed. All the patients were treated with an overdenture on a round-shaped bar (Cendres & Metaux, Biel, Switzerland) with the Ackerman clip retention system (Preat Corporation, Santa Ynez, CA, USA). With the Brånemark implant system, standard abutments of 4 mm height were used; with the IMZ implant system, titanium connectors of 4 mm height were used. A new maxillary denture was made. A uniform prosthetic procedure was performed for all the patients (teeth: Ivoclar-Vivadent, Ellwangen, Germany; acrylic resin base material: Vertex-Dental B.V., Zeist, the Netherlands). A balanced occlusion and monoplane articulation with porcelain anterior teeth and acrylic resin posterior teeth was used in both the groups. The base of the overdenture was composed of acrylic resin without a metal reinforcement. The patients were subjected to a strict oral hygiene programme.

Clinical measurements

The clinical analysis included the following parameters:

- Plaque index according to Mombelli (score 0–3) (Mombelli et al. 1987).
- Presence of calculus around each implant (0 = no calculus, 1 = some degree of calculus).
- Bleeding index according to Mombelli (score 0–3) (Mombelli et al. 1987).
- Gingiva index according to Löe and Silness (score 0–3) (Löe & Silness 1963).
- Probing depth, which was measured with a periodontal probe (Merit-B, HuFriedy, Chicago, IL, USA) at four sites around the implants.
- Lip or chin dysesthesia, which was tested by touching the skin with a cotton pellet.

The clinical items were scored 1, 5 and 10 years after functional loading of the implants.

Radiographical evaluation

Rotational panoramic radiographs were taken 1 year after functional loading of the implants and 5 and 10 years after functional loading. Possible bone loss around the implants was classified according to the following scale:

0 = no apparent bone loss,
1 = reduction of bone level not exceeding one-third of the length of the implant,
2 = reduction of bone level exceeding one-third of the length of the

Table 1. **Characteristics of the groups at the baseline of the study**

	IMZ group ($n = 29$)		Brå group ($n = 32$)	
	Mean	SD	Mean	SD
Age (years)	59	11	55	12
Gender number (male/female)	9/20		12/20	
Edentulous period lower jaw (years)	23	11	19	9
Number of mandibular dentures	3	1	3	1
'Age' present lower denture (years)	8	5	7	5
Mandibular bone height (mm)	17	5	17	4

implant, but not exceeding one-half of the length of the implant,
3 = reduction of bone level exceeding one-half of the length of the implant.

Recording of surgical and prosthetic aftercare

The following surgical items were scored during the 10 years of follow-up:

- implant loss and re-implantation,
- treatment of gingival hyperplasia,
- placement of palatal mucosa grafts around the implants.

The following prosthetic items were scored during the 10 years of follow-up:

- broken abutments or coping screw,
- new or repair of bar and/or gold cylinders,
- new clips or fastening of loose clips,
- relining upper denture,
- relining lower denture,
- repair denture base or denture teeth,
- readjustment of occlusion,
- new upper denture,
- new lower denture.

Surgical items were counted from the day of the implant operation procedure until 10 years after insertion. Prosthetic items, however, were taken into account from 6 months after placement of the prosthesis until 10 years after insertion of the implants. Prosthetic alterations within 6 months were considered as part of the prosthetic treatment procedure.

Clinical implant performance scale

To compare different implant systems, the clinical implant performance scale (CIP scale) was used (Milholland et al. 1973; Geertman et al. 1996; Boerrigter et al. 1997; Van Waas et al. 1997). Each complication has a rating on a five-point rating scale. The highest rating given to each patient was used for the analysis. The CIP scale included the following ratings:

0 = success; no complications,
1 = minor complications,
2 = complications with a chance of recovery or stabilization of the present situation,
3 = serious complications that may lead to failure of the implant system,
4 = failure of the implant system.

Minor complications (CIP = 1) were gingival hyperplasia, relining of maxillary or mandibular denture, readjustment of occlusion, clip loosening, coping screw loosening, broken abutment, a slight disturbance of the mental nerve, probing depth = 6 mm and X-ray score 1 along with probing depth = 5 mm.

Complications with a chance of recovery or stabilization of the present situation (CIP = 2) were correction of a non-fitting superstructure, fracture of the superstructure, a severe disturbance of the mental nerve, X-ray score 1 along with probing depth = 6 mm and X-ray score 2 along with probing depth = 5 mm.

Serious complications (CIP = 3) were scored in the case of an X-ray score 2 along with probing depth = 6 mm, X-ray score 3.

Failure of the implant system (CIP = 4) was removal of one (or two) implants after the superstructure was placed.

Data analysis

In analyzing the clinical aspects, the χ^2 test and the Mann–Whitney *U*-test were used (SPSS version 9.0). A significance level of 0.05 was chosen.

Results

The clinical evaluation after 1 year could be carried out in 28 patients in the IMZ group due to one non-attendance patient and 31 patients in the Brå group (one drop-out due to death). After 5 years, again 28 patients in the IMZ group (one non-attendance) and 28 patients in the Brå group (two non-attendance, two death) were seen. After 10 years, the clinical evaluation could be carried out in 28 IMZ patients (one non-attendance) and in 25 Brå patients (two non-attendance, four death, one moved abroad). The aftercare during 5 and 10 years could be recorded for all 29 IMZ patients and for 30 Brå patients after 5 years (two death) and for 27 Brå patients after 10 years (four death, one moved abroad). Differences in the number of patients between clinical evaluation and aftercare can be explained by the fact that the aftercare can be scored from the patient's record, whereas the patient himself is not present at the appointment for evaluation (non-attendance). It was assumed that drop-out and non-attendance were independent of the clinical state of the patients.

Clinical analysis

The mean scores on the indices for plaque, gingiva, bleeding and calculus were very low at all three evaluation moments (Table 2). There was a significantly better gingiva score for the Brå group at the 1-year evaluation. The mean probing depth was 4.9 mm in the IMZ group and 3.6 mm in the Brå group after 1 year, which is a significant difference. At the 5-year evaluation, there was no significant difference anymore, but after 10 years the probing depth was again significantly larger in the IMZ group. The results show a reduction in the probing depth of 4.9 mm (IMZ group) and 3.6 mm (Brå group), at the 1-year evaluation to 3.7 mm (IMZ group) and 3.3 mm (Brå group) at the 5-year evaluation. Between 5 and 10 years, there was a rise to 4.7 mm (IMZ group) and 3.4 mm (Brå group). Four patients (two in the IMZ group, two in the Brå group) complained at the 1-year evaluation about dysesthesia of the lip or chin. After 5 and 10 years, none of the patients complained about these items.

Radiographical analysis

Table 3 shows the bone level scores 1, 5 and 10 years after insertion of the dentures. Of each implant, the most unfavorable value was taken to quantify the bone level. The bone level at 1 year around the implants is significantly higher in the IMZ group compared with the Brå group. At the 5-year evaluation, there is no significant difference. After 10 years, the bone level is significantly higher in the Brå group. Comparing the bone levels between 1 and 10 years of the IMZ group, there is no significant difference, whereas in the Brå group the bone level at 10 years is significantly higher than at the 1-year evaluation.

Analysis of surgical and prosthetic aftercare

Eight implants (three IMZ implants in two patients, five Brånemark implants in three patients) were lost during the first year of follow-up (all during the osseointegration period of 3 months). Another five implants were lost between 1 and 5 years (one IMZ implant, four Brånemark implants in two patients). No implants were lost between 5

Table 2. **Mean values (SD) of plaque index, gingiva index, bleeding index, calculus index and probing depth at the 1-, 5- and 10-year evaluation and significance level of the differences between the implant systems (χ^2 test)**

	1 year			5 years			10 years		
	IMZ ($n=28$)	Brå ($n=31$)	Significance	IMZ ($n=28$)	Brå ($n=28$)	Significance	IMZ ($n=28$)	Brå ($n=25$)	Significance
Mean plaque index (SD) (possible score 0–3)	0.5 (0.6)	0.5 (1.0)	Not significant	0.7 (0.7)	0.5 (0.8)	Not significant	0.8 (1.0)	0.8 (1.0)	Not significant
Mean gingiva index (SD) (possible score 0–3)	0.5 (0.6)	0.2 (0.6)	Significance $P=0.014$	0.3 (0.4)	0.3 (0.5)	Not significant	0.3 (0.7)	0.4 (0.6)	Not significant
Mean bleeding index (SD) (possible score 0–3)	0.8 (0.6)	0.6 (0.8)	Not significant	0.1 (0.3)	0.1 (0.3)	Not significant	0.7 (0.7)	0.6 (0.6)	Not significant
Mean calculus index (SD) (possible score 0–1)	0.2 (0.4)	0.1 (0.3)	Not significant	0.3 (0.4)	0.1 (0.3)	Not significant	0.3 (0.5)	0.2 (0.4)	Not significant
Mean probing depth (mm) (SD)	4.9 (1.3)	3.6 (1.2)	Significance $P=0.0002$	3.7 (1.0)	3.3 (0.9)	Not significant	4.7 (1.8)	3.4 (1.0)	Significance $P=0.0003$

Table 3. **Frequencies of bone level scores around IMZ implants and Brånemark implants 1, 5 and 10 years after insertion of the denture**

Score	1 year		5 years		10 years	
	IMZ implants ($n=56$)	Brå implants ($n=62$)	IMZ implants ($n=56$)	Brå implants ($n=56$)	IMZ implants ($n=56$)	Brå implants ($n=50$)
0	38	18	45	49	37	47
1	16	41	10	6	19	2
2	2	2	1	0	0	0
3	0	1	0	1	0	1
Mean score	0.4	0.8	0.2	0.2	0.3	0.1
P-value (Mann–Whitney)	0.0004		0.30		0.001	

0=no apparent bone loss, 1=reduction <1/3 of implant length, 2=reduction between 1/3 and 1/2 of implant length, 3=reduction >1/2 implant length.

and 10 years. All patients were re-operated successfully (Table 4a). In both the groups, multiple prosthetic revisions took place during 10 years of aftercare (Table 4b). A large amount of broken abutments/loose coping screws could be counted in the IMZ group compared with the Brå group. The total number of aftercare actions does not differ remarkably between the IMZ patients and Brå patients. Statistical differences in aftercare between the two systems are part of the CIP scale.

Clinical implant performance scale

Five patients in the IMZ group and six patients in the Brå group were without complications during 5 years of follow-up. No patient in the IMZ group and two patients in the Brå group were without complications during the entire 10 years of follow-up (Table 5). One patient in the IMZ group and two patients in the Brå group obtained score 4, which is a failure of the implant system. There is no significant difference at the 5 and 10 years evaluation between the groups.

Discussion

The clinical scores are comparable with those of Batenburg et al. (1994), Geertman et al. (1996) and Meijer et al. (1998), in whose studies the same criteria were used. Apparently, a tight oral hygiene regimen to which patients in these studies were subjected, provides healthy peri-implant soft tissues. Regarding the reduction in probing depth between the 1-year evaluation and the 5-year evaluation, some bone growth in the first few years is possible, but can also be ascribed to the low reliability of the probing depth measurement, because probing is very painful for most patients. Since a standardized probing force was not used in this study and there were different observers at the 1-year evaluation and the 5- and 10-year evaluation, inter-observer differences could be large and may have caused this reduction. Four patients complained about dysesthesia of the lip or chin at the 1-year evaluation. At the 5- and 10-year evaluation this problem was not present anymore. None of the involved implants was positioned in the direct vicinity of the alveolar nerve. Probably there were only minor disturbances in sensibility, which disappeared in time.

The rotational panoramic radiograph is widely used for the evaluation of bone around dental implants in edentulous mandibles. However, this technique suffers

Table 4a. **Surgical aftercare during 10 years of follow-up**

	Period 0–5 years		Period 5–10 years		Total period 0–10 years	
	IMZ group ($n=29$)	Brå group ($n=30$)	IMZ group ($n=29$)	Brå group ($n=27$)	IMZ group ($n=29$)	Brå group ($n=27$)
Implant loss	4	9	0	0	4	9
Gingivectomy	5	0	0	1	5	1
Palatal grafts	3	1	1	1	4	2

Table 4b. **Prosthetic aftercare during 10 years of follow-up**

	Period 0–5 years		Period 5–10 years		Total period 0–10 years	
	IMZ group ($n = 29$)	Brå group ($n = 30$)	IMZ group ($n = 29$)	Brå group ($n = 27$)	IMZ group ($n = 29$)	Brå group ($n = 27$)
Broken abutments/loose coping screws	13	1	2	0	15	1
New bar/gold cylinders	1	3	11	5	12	8
New/fastening clips	8	13	14	24	22	36
Relining upper denture	8	12	3	5	11	16
Relining lower denture	8	5	3	5	11	9
Repair denture base/teeth	14	19	21	12	35	31
Readjustment of occlusion	3	10	4	10	7	19
New upper denture	0	0	8	1	8	1
New lower denture	1	1	7	1	8	2
Total number of aftercare actions	56	64	73	63	129	127

Table 5. **Clinical Implant Performance scale after 5 and 10 years of follow-up**

CIP scale	5 years		10 years	
	IMZ group ($n = 28$)	Brå group ($n = 28$)	IMZ group ($n = 28$)	Brå group ($n = 25$)
Score 0	5	6	0	2
Score 1	21	19	23	20
Score 2	1	1	4	0
Score 3	0	0	0	1
Score 4	1	2	1	1
Mean	1.0	1.0	1.3	1.2
P-value (Mann–Whitney)	0.98		0.30	

from a lack of sharpness, distortion of the images, superimposition of the bony structures of the spine, and has problems with reproducibility. The parallelling technique, with the use of an intra-oral filmholder, would be favorable (Meijer et al. 1992). Because of the use of panoramic radiographs at the beginning of the study, this technique was continued and evaluation of bone level changes was carried out in proportion to the length of the implants instead of directly in millimeters (Batenburg et al. 1994, Geertman et al. 1996). No bone loss could be detected around 57% of the IMZ implants at the 1-year evaluation, whereas around the Brånemark implants no bone loss could be observed around 15%. This significant difference can possibly be explained by the different surgical procedures of the implant systems. The Brånemark system uses a countersink for the neck of the implants, which is not used for the IMZ system. After 5 years, there is no difference anymore between the two systems, whereas after 10 years the difference is in favor of the Brå group. Comparing the 1- and 10-year results of both groups, it can be noticed that the bone level around the IMZ implants remains stable and the bone level around the Brånemark implants increases during the 10 years. It is possible that the removed bone from the countersink comes back to the level of the surrounding bone during a remodelling process after 1 year. Because of the difficulties in measuring bone level on panoramic radiographs, one may not draw firm conclusions with respect to this item.

Eight implants were lost during the osseointegration period. Another five implants were lost after construction of the prosthesis. All the patients were re-operated successfully. Including loss of implants during the osseointegration period gives a survival rate of 89% after 5 years. This is rather low compared with the studies of Buser et al. (1999) (96.2%), Mericske-Stern et al. (2001) (91.4%) and Ferrigno et al. (2002) (95.9%). In not all studies is it very clear if implants lost during the osseointegration period are included. If not, a survival rate of 96% can be noted in this study. Despite the unequal number of lost implants (four in the IMZ group, nine in the Brå group), this difference is not significant.

When analyzing the prosthetic aftercare, the large number of broken abutment/loose coping screws in the IMZ group is noticeable. In almost all cases, this appeared to be the 4 mm high titanium connector of the 3.3 diameter implant. With the 4.0 diameter implants no broken abutments occurred. All overdentures were initially provided with two Ackermann clips. It appeared in time that these small clips were subject to fracture or loosening of the retention flanges. As alternative Friatec clips (which fitted on the same round bar) were applied in case clips fractured repeatedly or the bar was changed into a thick egg-shaped Dolderbar with matching clips. Multiple repairs of denture base and teeth can be noticed. The relatively large bar superstructure results in a large space in the frontal base of the overdenture. Increased chewing force may exceed the strength of the available acrylic resin. Acrylic resin posterior teeth were used in combination with porcelain anterior teeth. In time, the protrusive articulation was obstructed because of the abrasion of the posterior teeth, which could result in loss of stability of the upper denture and/or fracture of anterior teeth. To prevent abrasion, porcelain posterior teeth were used later on. Multiple corrections of the precision attachment system were also mentioned in the studies of Hemmings et al. (1994), Versteegh et al. (1995) and Watson et al. (1997). Apparently, the connection of the removable part (overdenture) to the fixed part (bar superstructure) is very critical. A firm fixation of the retentive flanges in the acrylic resin of the denture base and also a solid construction of the retentive system itself is necessary to reduce prosthetic aftercare.

Analyzing the CIP scores, it can be noticed that the majority of patients in both the groups were subject to minor complications. There is no significant difference between the two groups.

From this study, it can be concluded that both the IMZ implant and the Brånemark implant systems supporting an overdenture function well after 10 years of follow-up. There are no indications of a worsening of clinical or radiographical state after 10 years. Multiple prosthetic revisions were necessary with both implant systems; especially the precision attachment system in the overdenture and the denture base and teeth were subject to frequent fracture.

Résumé

Le but de cet essai clinique contrôlé randomisé et prospectif a été d'évaluer les conséquences cliniques et prothétiques chez des patients édentés avec une prothèse mandibulaire retenue par deux implants IMZ ou *ad modum* Branemark durant une décennie. Les patients ont été répartis soit dans le groupe IMZ (n = 29) soit le Branemark (n = 32) par ordinateur. Dans le groupe IMZ, quatre implants ont été perdu durant cette décennie ce qui signifie un taux de survie de 93%. Dans le groupe Branemark, neuf implants ont été perdus entraînant un taux de survie de 86%. Tous les patients ont été réopérés avec succès. Des révisions prothétiques multiples ont été nécessaires dans les deux groupes; le système d'attache de précision dans la prothèse (23% du nombre total des révisions) et la base de la prothèse et les dents (26% du nombre total des révisions) sujets à de multiples fractures. Tant les implants IMZ que les Branemark sont des implants permettant de fixer une prothèse qui fonctionne bien après une décennie. Il n'y avait aucune indication d'une dégradation de l'état clinique ou radiographique après cette durée.

Zusammenfassung

Das Ziel dieser randomisierten prospektiven und kontrollierten klinischen Studie war, die Befunde der prothetischen Nachsorge bei zahnlosen Patienten auszuwerten, die über eine Zeitspanne von 10 Jahren eine Unterkieferhybridprothese auf zwei IMZ-Implantaten oder zwei Brånemarkimplantaten getragen hatten. Die Patienten ordnete man mit einem komputergesteuerten Auswahlverfahren der IMZ-Gruppe (n = 29) oder der Brånemark-Gruppe (n = 32) zu. In der IMZ-Gruppe gingen in der 10-jährigen Versuchsphase vier Implantate verloren (Überlebensrate von 93%). In der Brånemark-Gruppe gingen neun Implantate verloren (Überlebensrate von 86%). All diese Patienten konnten erfolgreich nachoperiert werden. In beiden Gruppen waren zusätzlich verschiedene prothetische Eingriffe nötig. Insbesondere das Präzisions der Hybridprothesen (23% aller Reparaturen) und die Prothesenbasis und -zähne (26% aller Reparaturen) mussten öfters wegen Frakturen repariert oder ersetzt werden. Aus dieser Studie kann man schliessen, dass sich sowohl das IMZ-System wie auch das Brånemarksystem gut eignen, um eine Hybridprothese über eine 10 jährige Beobachtungszeit zu fixieren. Es gibt nach 10 Jahren keine Anzeichen einer Verschlechterung des klinischen oder des röntgenologischen Zustandes.

Resumen

La intención de este ensayo clínico controlado prospectivo aleatorio fue evaluar los resultados clínicos cuidados protésicos de pacientes edéntulos con dentadura mandibular retenida por dos implantes IMZ o Brånemark durante un periodo de diez años. Los pacientes se alojaron en el grupo IMZ (*n* = 29) o Brånemark (*n* = 32) por medio de un método de balanceo computarizado. En el grupo IMZ se perdieron cuatro implantes durante lo diez años de seguimiento (índice de supervivencia: 93%). En el grupo Brånemark se perdieron nueve implantes (índice de supervivencia: 86%). Todos los pacientes fueron reoperados con éxito. Se necesitaron múltiples revisiones protésicas en ambos grupos, especialmente el sistema de atache de precisión en la sobredentadura (23% del número total de revisiones) y la base y los dientes de la sobredentadura (26% del número total de revisiones) sufrieron frecuentes fracturas. De este estudio se puede concluir que tanto el sistema de implantes IMZ como el sistema de implantes Brånemark soportando una sobredentadura funcionan bien tras diez años de seguimiento. No hay indicaciones de empeoramiento del estado clínico o radiográfico tras diez años.

要旨

本前向き無作為化対照つき臨床試験では、２本のIMZインプラントかBranemarkインプラントで支持する下顎オーバーデンチャーを入れた無歯顎患者について臨床的結果と補綴物のアフターケアーの評価を１０年間行った。コンピュータ化した分散法によって患者をIMZ群（ｎ＝２９）かBranemark群（ｎ＝３２）に振り分けた。１０年間の追跡調査期間にIMZ群では４本のインプラントが失われた（生存率：９３％）。Branemark群では９本のインプラントが失われた（生存率：８６％）。これらの患者は全て再手術が成功した。両群とも複数回の補綴物の修理が必要であり、特にオーバーデンチャーの精密アタッチメント・システム（修理合計回数の２３％）と、義歯床と人工歯（修理合計回数の２６％）は頻回に破折した。本研究では、１０年後の追跡調査においてIMZインプラント・システムもBranemarkインプラント・システムもオーバーデンチャーの支持として良好に機能していると結論された。１０年後に臨床的にあるいはレントゲン像によって、状態が悪化している兆候はみとめられなかった。

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